

TABLE C-2. NATO COMBAT DIVISIONS AVAILABLE FOR A CONFLICT IN THE CENTRAL REGION

National Affiliation	Divisions a/ Reinforcements			Total
	In Place b/	Active c/	Reserve d/	
United States	5 $\frac{1}{3}$	10	15	30 $\frac{1}{3}$
West Germany	12	0	3 $\frac{1}{3}$	15 $\frac{1}{3}$
Belgium	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{2}{3}$	2
Canada	$\frac{1}{3}$	0	0	$\frac{1}{3}$
Denmark	0	2	0	2
France e/	3	12	0	15
Netherlands	$\frac{1}{3}$	1 $\frac{2}{3}$	1 $\frac{1}{3}$	3 $\frac{1}{3}$
United Kingdom	3	$\frac{2}{3}$	0	3 $\frac{2}{3}$
Total	24 $\frac{2}{3}$	27	20 $\frac{1}{3}$	72

SOURCE: Congressional Budget Office based on data from William P. Mako, *U.S. Ground Forces and the Defense of Central Europe* (Washington, D.C.: Brookings Institution, 1983); International Institute for Strategic Studies, *The Military Balance, 1987-1988* (London: IISS, 1987); Department of Defense, Office of the Assistant Secretary of Defense for Program Analysis and Evaluation, *NATO Center Region Military Balance Study, 1978-1984* (July 1979); Diego A. Ruiz Palmer, "Between the Rhine and the Elbe: France and the Conventional Defense of Central Europe," *Comparative Strategy*, vol. 6, no. 4(1987), pp. 489 and 490; and Association of the U.S. Army, "The Total Army at a Glance," *Army* (May 1988).

- a. Includes separate brigades and armored cavalry regiments (ACRs). Three brigades or three ACRs are considered equivalent to one division.
- b. All of these forces could be available within one to three days after NATO starts to mobilize. A small fraction (about one-eighth) are on constant alert, however, and would be available immediately.
- c. All of these forces, except those from the United States, could be available within a week after NATO starts to mobilize. Six of the U.S. divisions would be available within 10 days of NATO's mobilization.
- d. The European reserves could be available within one week after NATO starts to mobilize. The last U.S. reserve unit included here would arrive 79 days after mobilization.
- e. France, although not a military member of NATO, does have bilateral agreements with West Germany stating that France will come to West Germany's aid if the latter is attacked.

- o Category I. Can attain full personnel strength after 24 hours' notice and is fully equipped.
- o Category II. Typically at 50 percent to 75 percent personnel strength with complete set of fighting vehicles.

- o Category III. Cadre divisions maintained at 20 percent personnel level, possibly with a complete set of combat equipment, though typically of older vintage.2/

The amount of time needed to bring divisions in Categories II and III up to combat-ready status is a much-debated topic. Estimates range from 7 to 30 days for Category II divisions and from 15 to 120 days for Category III divisions.3/ It must be noted, however, that all of the Soviet units stationed in eastern Europe outside of the Soviet Union are maintained at the highest level of readiness. These troops would most likely spearhead any Soviet invasion of central Europe.

NATO

NATO units would also need time to prepare for combat. Of the units permanently stationed in Europe, only a fraction--primarily reconnaissance battalions and cavalry regiments--are maintained on 24-hour alert. The remaining 20 or so divisions would need one to three days to reach full strength and to move from their peacetime locations to positions appropriate for impeding a Pact advance. The European nations could quickly provide 17 reinforcing divisions (within three to seven days), and the United States could provide another six divisions rapidly. These six divisions, though stationed in the United States during peacetime, maintain an extra set of equipment in Europe through a program that prepositions combat equipment in West Germany. This allows the personnel to be flown to Europe, pick up their equipment from special warehouses (a process that takes about a day), and be ready for combat.

The United States can provide an additional four active divisions within 30 days, and 15 reserve divisions theoretically within 79 days after mobilization. During the United States' last experience with a

2. International Institute for Strategic Studies, *The Military Balance, 1987-1988* (London: IISS, 1987), p. 34.

3. William P. Mako, *U.S. Ground Forces and the Defense of Central Europe* (Washington, D.C.: Brookings Institution, 1983), p. 60; Tom Gervasi, *The Myth of Soviet Military Supremacy* (New York: Harper and Row, 1986); Department of Defense, *Soviet Military Power, 1987* (1987); Secretary of Defense, *Annual Report to the Congress, Fiscal Year 1982* (1981), p. 69; Department of Defense, Office of the Assistant Secretary of Defense for Program Analysis and Evaluation, *NATO Center Region Military Balance Study, 1978-1984* (July 1979), p. I-6.

large-scale mobilization of reserves--in the Korean War--however, mobilization delays were much longer than 79 days. During that conflict, seven months were required to mobilize, equip, and train each reserve division or brigade before it could be sent overseas.^{4/}

Another factor that will affect the Pact/NATO force balance is the rapidity with which NATO responds to a Pact mobilization. Once Western sources have detected Pact movement to a war status, each NATO country must begin to mobilize its defenses. The time lag between initiation of Pact mobilization and NATO's response to it could have a serious impact on force ratios early in the mobilization process (see Chapter II).

To take into account the wide range of possible conditions that could exist at the start of a conflict between NATO and the Warsaw Pact, CBO examined the force balance in Europe within the context of three scenarios. The scenarios range from one that makes assumptions that favor NATO to one that favors the Warsaw Pact. The scenarios were discussed fully in Chapter II and are defined as follows:

- o More Favorable to NATO. NATO responds immediately to a Pact mobilization and begins to mobilize simultaneously. France participates fully in NATO efforts, while Polish and Czech forces do not participate in a Warsaw Pact mobilization. Ninety days are required for all of the divisions from the Soviet central military districts to become combat-ready and reach the front.
- o Less Favorable to NATO. NATO does not begin to mobilize until seven days after the Pact mobilizes. France does not contribute forces to NATO, but Polish and Czech forces participate in Warsaw Pact efforts. All Warsaw Pact forces destined for the central region are available within 25 days of the call to mobilize.
- o Middle-Range Scenario. NATO mobilizes four days after the Warsaw Pact. France, Poland, and Czechoslovakia partici-

4. Congressional Budget Office, *Improving the Army Reserves* (November 1985), p. 2.

pate with their respective alliances. All Warsaw Pact forces are available for combat 60 days after mobilization begins.

Additional details about the three scenarios are listed in Table C-3.

TABLE C-3. ASSUMPTIONS MADE IN GENERATING THREE SCENARIOS FOR CONFRONTATION IN THE CENTRAL REGION BETWEEN NATO AND THE WARSAW PACT

Assumption	Scenario		
	More Favorable	Middle-Range	Less Favorable
NATO			
French Forces Included	Yes	Yes	No
Mobilization Delay (Days) <u>a/</u>	0	4	7
Warsaw Pact			
Polish and Czech Forces Included	No	Yes	Yes
Arrival of Last Unit in Theater (Days after mobilization)			
Soviet forces in:			
East Germany	7	4	2
Czechoslovakia	7	4	2
Poland	15	4	2
East German forces	7	4	2
Czech forces	n.a.	4, 8 <u>b/</u>	7
Polish forces	n.a.	8	7
Soviet forces			
Western military districts	42	15	15
Central military districts	90	60	25

SOURCE: Congressional Budget Office based on data from William P. Mako, *U.S. Ground Forces and the Defense of Central Europe* (Washington, D.C.: Brookings Institution, 1983); and Department of Defense, Office of the Assistant Secretary of Defense for Program Analysis and Evaluation, *NATO Center Region Military Balance Study, 1978-1984* (July 1979).

NOTE: n.a. = not applicable.

- a. Delay between initiation of Warsaw Pact mobilization and start of NATO mobilization.
- b. Six of the ten Czech divisions would be available for combat four days after mobilization; the remaining four, four days later.

TABLE C-4. NATO TACTICAL AIRCRAFT IN THE CENTRAL REGION, AT MOBILIZATION AND TEN DAYS LATER

	Fighter-Bombers			Fighters		
	Aircraft	M-Day	M + 10	Aircraft	M-Day	M + 10
NATO Total		1,498	2,797		586	802
United States	F-111	140	220	F-5E	19	19
	A-10	108	378	F-15C/D	96	312
	F-16A/B	240	408			
	A-7	0	252			
	F-4	24	288			
Total		512	1,546		115	331
Belgium	Mirage 5BA	50	50	F-16A/B	36	36
	F-16A/B	36	36			
Total		86	86		36	36
Canada	CF-18	36	36	n.a.	n.a.	n.a.
Denmark	F-16A/B	24	24	F-16A/B	24	24
	Draken	16	16	Draken	16	16
Total		40	40		40	40
France	Mirage F-IIIIE	60	60	Mirage F-1C	120	120
	Mirage F-5F	30	30	Mirage F-IIIIC	10	10
	Jaguar-A	24	116	Mirage F-IIIIE	15	15
				Mirage F-2000	38	38
Total		114	206		183	183
Germany	F-104G	80	80	F-4F	60	60
	F-4F	60	60			
	Tornado	103	103			
	Alphajet	175	175			
Total		418	418		60	60
Netherlands	F-16A/B	56	56	F-16A/B	56	56
	F-5	49	70			
Total		105	126		56	56
United Kingdom	Tornado	108	180	Tornado	12	12
	Harrier	31	51	Lightning	12	12
	Jaguar	48	108	F-4	72	72
Total		187	339		96	96

SOURCE: Congressional Budget Office using data from Secretary of Defense, *Annual Report to the Congress, Fiscal Year 1983* (1982); International Institute for Strategic Studies, *The Military Balance, 1987-1988* (London: IISS, 1987); The Analytic Sciences Corporation, "Preliminary Atlantic-to-the-Urals Unclassified Conventional Weapon Systems Data Base," Personal communication, Fall 1987.

NOTE: n.a. = not applicable.

TABLE C-5. WARSAW PACT TACTICAL AIRCRAFT IN THE CENTRAL REGION, AT MOBILIZATION AND TEN DAYS LATER

	Fighter-Bombers			Fighters			Interceptors		
	Aircraft	M-Day	M+10	Aircraft	M-Day	M+10	Aircraft	M-Day	M+10
Warsaw Pact Total		1,204	1,249		1,130	1,220		535	795
Soviet Union	MiG-21	45	45	MiG-21	180	180	Su-15	0	90
	MiG-27	405	405	MiG-23	400	445	Su-27	0	45
	Su-17	180	225	MiG-29	155	200	Tu-128	0	35
	Su-24	45	45				MiG-25	0	45
	Su-25	90	90				MiG-31	0	45
Total		765	810		735	825		0	260
Czechoslovakia	MiG-21	30	30	MiG-21	95	95	MiG-21	90	90
	MiG-23	40	40	MiG-23	45	45	MiG-23	45	45
	Su-7	50	50						
	Su-25	25	25						
Total		145	145		140	140		135	135
East Germany	Su-22	40	40	MiG-21	205	205			
	MiG-23	24	24	MiG-23	50	50			
Total		64	64		255	255			
Poland	MiG-17	80	80				MiG-21	292	292
	Su-7	30	30				MiG-23	108	108
	Su-22	120	120						
Total		230	230					400	400

SOURCE: Congressional Budget Office based on data in International Institute for Strategic Studies, *The Military Balance, 1987-1988* (London: IISS, 1987); and The Analytic Sciences Corporation, "Preliminary Atlantic-to-the-Urals Unclassified Conventional Weapon Systems Data Base," Personal communication, Fall 1987.

TACTICAL AIR FORCES

In a European conflict, both sides would have large numbers of tactical aircraft at their command (see Table C-4 on the preceding page and Table C-5 above). Unlike ground forces, aircraft can be readied quickly and transported rapidly from one place to another. Indeed, reinforcing aircraft for both NATO and the Pact should be available within 10 days after mobilization.

In this study, NATO's reinforcing aircraft consisted of 60 U.S. tactical aircraft squadrons based in the United States and Spain during peacetime, plus about 260 additional aircraft from European

air forces. All other NATO aircraft are currently based in the central region or Great Britain.

Tallies of the Warsaw Pact aircraft include those permanently stationed in the central region and those assigned to the western and central military districts of the Soviet Union. The interceptor aircraft assigned to the individual national air defenses are also included in these tallies. Although these aircraft would probably not take part in Pact offensive operations into NATO territory, they could be used to counter NATO airstrikes in East Germany, Czechoslovakia, or Poland.



APPENDIX D

SYSTEMS FOR AND ANALYSIS OF FOLLOW-ON FORCES ATTACK

The philosophy behind the postulated NATO strategy of attacking the follow-on forces (FOFA) is to try to prevent an enemy--generally assumed to be the Warsaw Pact--from bringing all of its reinforcing units into the battle area. Specifically, FOFA would attempt to reduce the impact of the Pact's reinforcements by attacking rail lines and bridges in eastern Europe to delay their arrival in theater and by attacking the follow-on or "second-echelon" combat units themselves as they move closer to the front.

DELAY OF FOLLOW-ON FORCES

As stated in Chapter II, more than half of the total Pact forces that would eventually fight in the central European theater are, in peacetime, based in the Soviet Union. To play a role in central Europe, these units would have to travel from their permanent locations in the Soviet Union to the inter-German border. Forces being transported from the Soviet Union by rail must first transfer from broad-gauge Russian trains to narrow-gauge Polish trains at about eight transloading complexes along the Polish border. Subsequently, the major Polish east/west rail lines must cross the Vistula and Dunajec rivers. These few rail lines, the transloading areas, and the rail bridges across the major rivers present opportunities for NATO attacks that could result in significant delays in the transport of reinforcing units.

Current Capability

Targets near the Polish-Soviet border are about 600 to 850 kilometers east of the inter-German border. Aircraft are the only means that NATO has today for attacking railways in this region. NATO's current inventory of tactical aircraft, however, does not include any that

can reach the region near the Polish-Soviet border from their bases in England or Germany. (This statement is based on the assumption that the aircraft would carry both ground-attack and self-defense ordnance, would not be refueled, and would fly a profile designed to evade enemy air defenses.) Indeed, data provided by the Air Force to the Office of Technology Assessment (OTA) for a study of the feasibility of the FOFA strategy indicate that current aircraft can barely reach targets inside Poland.

Figure D-1 portrays the maximum distances that current U.S. fighter-bombers can travel to targets when carrying realistic loads of ordnance and self-protective gear and have enough fuel to return to their home bases. (The assumed payloads include 4,000 pounds of ground-attack munitions and self-defense weapons and are listed in Table D-1.) Furthermore, the combat radii portrayed in the figure assume that the aircraft fly at high altitude, which consumes less fuel, only when far removed from enemy air defenses. Any flight over West German or enemy territory is assumed to be at low altitude (200 feet) and 480 knots in order to avoid enemy air defense radars. Only F-111F aircraft, currently based in England, or F-15E aircraft based in Germany have the range to attack targets within Poland and return to base, and no U.S. tactical aircraft could attack targets along the Polish-Soviet border under the conditions outlined above.

Future Capability

At least two studies have concluded that strategic aircraft carrying air-launched, conventionally armed cruise missiles could perform the mission of destroying bridges and rail lines in eastern Europe.^{1/} In particular, a RAND study postulated the use of existing B-52 bomber aircraft to deliver conventional air-launched cruise missiles for just this mission. That study also speculated that cruise missiles capable of cutting enemy rail lines could be available within five years.

1. See Stephen T. Hosmer and Glenn A. Kent, *The Military and Political Potential of Conventionally Armed Heavy Bombers*, R-3508-AF (Santa Monica: RAND Corporation, August 1987); and Office of Technology Assessment, *New Technology for NATO: Implementing Follow-On Forces Attack* (OTA-ISC-309, June 1987).

Impact of Delaying Reinforcements

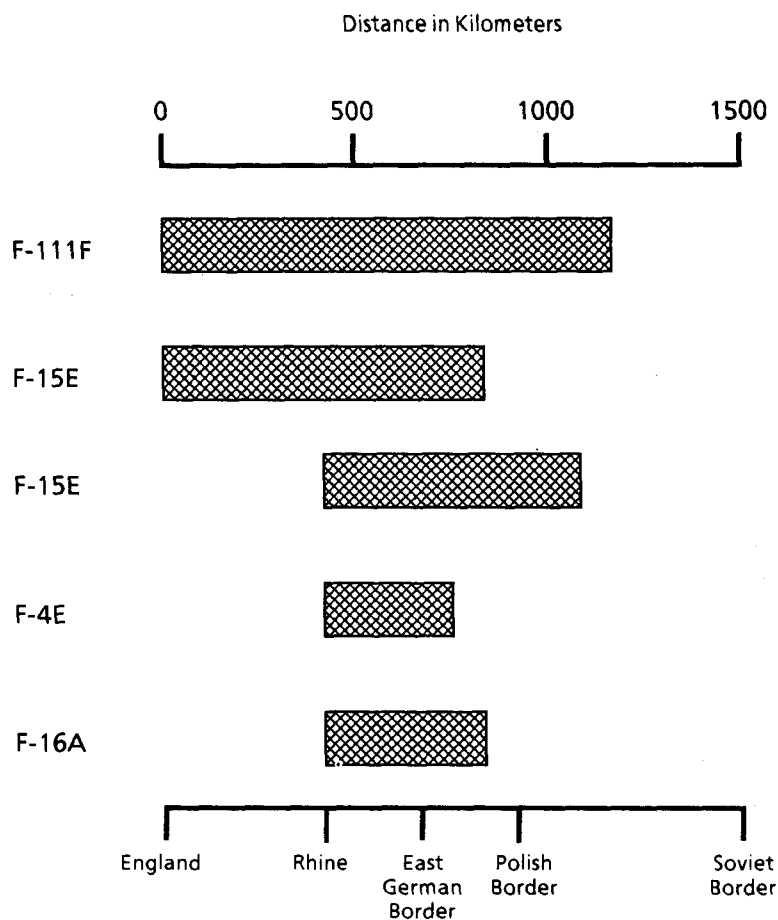
If attacks on the few bridges that cross the Vistula River were successful, they could delay the arrival of the last Soviet unit at the front by 9 to 15 days. Once damaged, railroad bridges are much more difficult to repair than bridges that carry roads, because the tracks must be precisely aligned. Furthermore, since the equipment for the reinforcing Soviet units will, at this distance from the inter-German border, be loaded onto rail cars, temporary bridging and ferries would not provide the Warsaw Pact with an efficient means for their transport across major rivers. If each coordinated cruise missile attack closes the bridges for three days, then three to five successive attacks during the mobilization period could result in 9 to 15 days of bridge closure and delay.

The Polish and East German rail networks would also be attacked by cruise missiles once every three days after the initial attack to prevent repair. Theoretically, by simultaneously derailing the locomotive and cutting the rails, delays of 18 to 24 hours could be imposed per attack. During a 60-day mobilization period, up to 20 attacks could be made at three-day intervals. Thus, if each attack caused 0.75 to 1.0 day of delay, 20 attacks could cause a delay of 15 to 20 days. When added to the 9 to 15 days of delay caused by the damaged bridges, a total delay of 24 to 35 days could be imposed on the arrival of the last Soviet unit at the front.

This study took a very conservative approach toward the total delay that could realistically be imposed by attacks on the Polish transportation network and assumed a total delay of 21 days. The effect of such a delay would be to slip the completion of Pact mobilization from 60 days to 81 days from its initiation. An increase in total mobilization time from 60 to 81 days would reduce the arrival rate of Warsaw Pact reinforcing units at the front from an average of one division every 1.5 days to about one division every 2.1 days.^{2/} Though subjec-

2. The impact of attacks on the eastern European rail network would be, to some extent, a function of when the attacks were initiated. If they did not begin until 15 days after the Pact started to mobilize, as was assumed here, most of the units from Poland and Czechoslovakia would already be in theater, and only those forces from the central military districts of the Soviet Union would still be in transit.

Figure D-1.
Combat Radii of U.S. Fighter-Bomber Aircraft



SOURCE: Office of Technology Assessment, *Technologies for NATO's Follow-On Forces Attack Concept* (July 1986).

NOTE: The radii reflect the maximum distances that current U.S. fighter-bombers can travel to targets and have enough fuel to return to their bases. These radii are based on illustrative payloads shown in Table D-1 and flight at low altitude over West Germany and eastern Europe.

TABLE D-1. ASSUMED LOADS FOR U.S. FIGHTER-BOMBER AIRCRAFT

Aircraft	Self-Defense Weapons <u>a/</u>	Ground-Attack Weapons <u>b/</u>	Miscellaneous Equipment
F-111F	2 Sidewinder missiles	2 Mk-84 bombs	ECM pod PAVE TACK target designation pod
F-15E	2 Sidewinder missiles 2 AMRAAM missiles	2 Mk-84 bombs	LANTIRN navigation and targeting pod 3 external fuel tanks 2 conformal fuel tanks
F-4E	2 Sparrow missiles	2 Mk-84 bombs	ECM pod 2 external fuel tanks
F-16A	2 Sidewinder missiles	2 Mk-84 bombs	ECM pod 2 external fuel tanks

SOURCE: Congressional Budget Office using data from Office of Technology Assessment, *Technologies for NATO's Follow-On Forces Attack Concept* (July 1986).

NOTE: The assumed loads are meant to place the range comparisons on a common basis, not to represent the preferred ordnance for actually attacking follow-on forces.

ECM = electronic countermeasures; AMRAAM = advanced medium-range, air-to-air missile; LANTIRN = low-altitude navigation and targeting infrared for night.

a. Air-to-air missiles.

b. The payload for each aircraft includes 4,000 pounds of ground-attack ordnance.

tive, these estimates are based on previous analyses conducted by respected analytic organizations such as the Institute for Defense Analyses.^{3/}

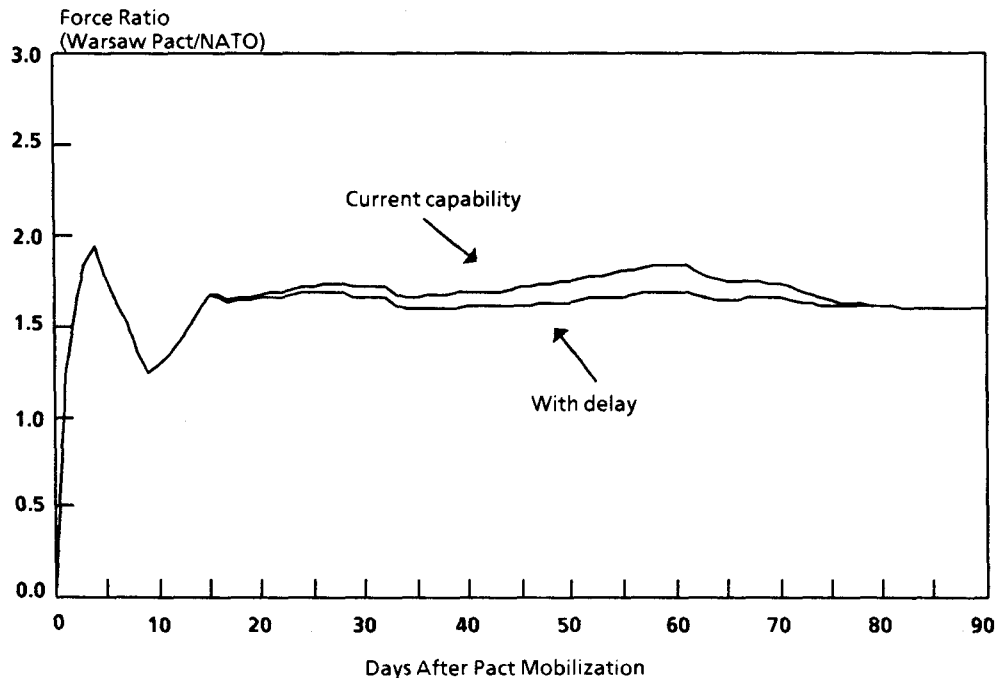
Theaterwide Capability. This delay could have a noticeable effect on the balance of forces (see Figure D-2). At a point 60 days after mobilization, for example, the ratio of Pact to NATO forces could be reduced by about 8 percent.

3. Institute for Defense Analyses, *Follow-On Force Attack*, R-302 (Alexandria, Va.: IDA, April 1986).

Corps Capability. In an already strong corps, such as the U.S. V Corps, the effect of the delay imposed by FOFA tends to have the same magnitude as the effect on the entire theater. (In analyzing results in a particular corps, a dynamic assessment was used. See Appendix A for a description of the dynamic model.)

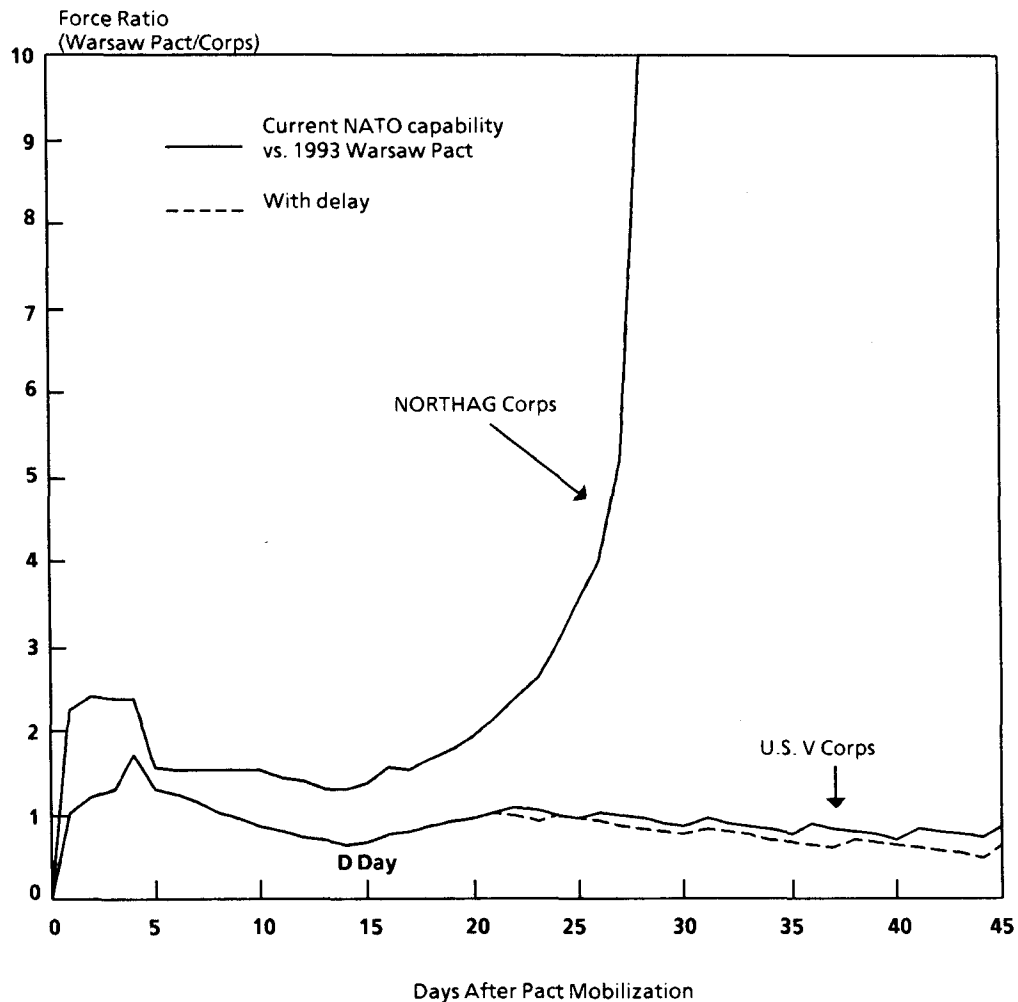
In those corps areas where the Pact currently seems to hold a considerable advantage, however, the story may be different. In the British I Corps or West German I Corps in the Northern Army Group (NORTHAG), for example, this strategy offers little improvement (see Figure D-3). Indeed, the dynamic analyses suggest that attacking the follow-on Pact forces is beneficial only if NATO can thwart the initial attack. If the initial forces cannot be stopped, attack of follow-on forces might be irrelevant.

Figure D-2.
Effect of Delay on Theaterwide Force Ratios



SOURCE: Congressional Budget Office based on Department of Defense data and on Office of Technology Assessment, *New Technology for NATO: Implementing Follow-On Forces Attack* (OTA-ISC-309, June 1987).

Figure D-3.
Simulated Effect of Delay on Force Ratios in Two NATO Corps



SOURCE: Congressional Budget Office based on Department of Defense data and on Office of Technology Assessment, *New Technology for NATO: Implementing Follow-On Forces Attack* (OTA-ISC-309, June 1987).

NOTE: Delay results in no improvement in the corps in NORTHAG.

DESTRUCTION OF FOLLOW-ON FORCES

FOFA may also be able to destroy some of the Pact reinforcing units before they arrive at the front. Pact reinforcing divisions would be

attacked during their move from divisional assembly areas, located about 80 kilometers from the forward edge of the battle area (FEBA), to regimental assembly areas, located about 30 kilometers from the forward edge. This move should take about six to eight hours for an entire division traveling over existing roads. Each division would move in about 55 small units or columns with about 60 vehicles in each column. Although NATO's sensors might not be able to detect each of the 55 columns as it moves from one assembly area to another (a process that would take about 1.5 to 3.0 hours for each column), the entire process would probably not go undetected for six to eight hours. This analysis assumes, therefore, that most of the columns from each division would be detected as they move from the divisional to regimental assembly areas.

Current Capability for Detection and Attack of Reinforcing Pact Divisions

NATO and the United States now have some limited capacity to detect and attack Pact second-echelon divisions as they move closer to the front. Neither the detection nor the attack systems that are available today are well suited for the task, however.

The U.S. Army and Air Force each have airborne sensors that can detect ground targets. These sensors include the Army's OV-1D Mohawk system and the Air Force's Advanced Synthetic Aperture Radar System II (ASARS II) radar on the TR-1 aircraft. Both systems have characteristics that make them unsuited for the FOFA mission. The OV-1D's range is not sufficient to detect moving enemy units out to 80 kilometers beyond the FEBA without exposing itself to enemy air defenses, and the ASARS II is better suited for detection of stationary targets. These two systems, however, could find some of the Pact's reinforcing columns as they proceed toward the front.

NATO's only current means for attacking enemy reinforcing units, once detected, would be tactical aircraft armed with bombs or standoff missiles, but the price of using those aircraft to carry out this mission might be high. According to a report by the Office of Technology Assessment, NATO has 1,000 aircraft theoretically available

for interdiction missions.^{4/} Many of these aircraft, however, have other missions in conventional war, including attack of enemy airfields, attack of enemy forces in direct combat with NATO troops (known as close air support), and attack of enemy command posts. Some aircraft may also be held in reserve to deliver nuclear weapons should hostilities escalate to that level. Moreover, losses of aircraft that attempt to attack reinforcing units could be high. Aircraft on such missions would have to penetrate up to 80 kilometers behind enemy lines and fly close to enemy combat units, each of which has its own air defense weapons. A recent study by the Institute for Defense Analyses (IDA) postulated loss rates of 13 percent per mission, which could be prohibitive for carrying out the FOFA mission.^{5/} Even if loss rates were substantially lower, commanders might not wish to use such expensive assets to attack reinforcing units.

Future Capability to Detect and Destroy Reinforcing Units

The Joint Surveillance and Target Attack Radar System (JSTARS), currently being developed jointly by the Army and the Air Force, is designed to find and track moving targets on the ground up to 300 kilometers beyond the forward edge of battle. The radar, as currently designed, will be mounted on a military version of a Boeing 707 aircraft. To provide continuous coverage of the entire area along the inter-German border, the Air Force plans to keep three JSTARS airborne at all times.

To destroy enemy reinforcements once they have been detected, the Army is developing the Army Tactical Missile System (ATACMS). ATACMS is a ballistic missile that would be launched from the same launcher as that used for the existing Multiple Launch Rocket System (MLRS). The missile would fly to a selected point above the target where it would dispense its submunitions. The initial version of ATACMS missiles will carry antipersonnel and antimateriel submunitions that are not effective against armored vehicles. An improved version, scheduled for production some time after the mid-1990s,

4. Office of Technology Assessment, *New Technology for NATO*, p. 137.

5. The IDA study is summarized in OTA, *New Technology for NATO*, p. 213.

would carry antiarmor submunitions that are guided to their targets by infrared or millimeter wave sensors.^{6/}

ATACMS missiles would be directed at those relatively small Pact columns (55 to a division) that are detected by JSTARS or other NATO sensors. Most of these columns, each of which has 60 vehicles, would consist entirely of trucks. Twenty-five or so, however, would each include about 30 combat vehicles such as tanks, armored personnel carriers, and artillery pieces. As currently designed, however, the JSTARS radar, or any other NATO sensor, would probably not be able to distinguish between trucks and armored vehicles. Attacks by these missiles would therefore have to be allotted to *all* reinforcing columns, since NATO would not be able to attack only those with high-value combat vehicles.

Several schemes could be envisioned for targeting each reinforcing Pact division. Each 60-vehicle column will stretch two to four kilometers and will probably be divided into about six company-sized units with 10 vehicles each. Companies will travel with a distance of 25 to 50 meters between vehicles and will, therefore, cover 250 to 500 meters of road surface. The submunitions within each ATACMS missile should be able to cover a segment of road approximately 800 meters long, and so one missile could be allotted to each company-sized unit, resulting in six missiles per column.^{7/} Thus, each missile--carrying approximately 16 to 20 submunitions--would be allocated to 10 vehicles, resulting in an average of two submunitions per vehicle. This is a relatively conservative allotment of resources.

Based on these assumptions, a targeting scheme of six missiles per column was assumed as a basis for the analysis in this study. Since not all of the vehicles within a given division would be detected, this is actually an average allocation scheme. It assumes that some company-sized units would not be attacked at all, but that others might receive more than one missile.

6. Infrared sensors detect heat emitted from objects such as tank engines. Millimeter wave sensors are radars that emit radio waves with wavelengths of a few millimeters and then detect their reflection from metal objects such as tanks.

7. James A. Tegnalia, "Emerging Technology for Conventional Deterrence," *International Defense Review* (May 1985), p. 644.

By allotting one ATACMS missile to each company-sized unit within each reinforcing Pact division, 330 ATACMS would be launched at each division during the six to eight hours that it moves from its divisional to regimental assembly areas. Opposite each NATO corps, there may be at most one divisional move per day. Thus, each U.S. corps would need to attack only one Pact reinforcing division per day. The 27 MLRS launchers assigned to each U.S. corps, therefore, would be required to launch 330 ATACMS missiles during the six- to eight-hour period of a divisional move, necessitating that each MLRS launcher fire slightly more than 12 ATACMS missiles in six to eight hours. One ATACMS missile will be loaded into each of the two pods on an MLRS launcher; each launcher would then have to be reloaded six times during that period--a feasible task, since MLRS launchers were designed to be reloaded rapidly.

The overall impact of attacking a reinforcing division with 330 ATACMS is a function of the effectiveness of each missile. The Army has not yet decided on the ultimate configuration of the antiarmor ATACMS. Each missile might carry as few as 16 large submunitions or as many as 96 smaller bombs. Furthermore, few unclassified estimates of the ultimate effectiveness of an antiarmor ATACMS missile are available. One assessment, by the Institute for Defense Analyses, concluded that an ATACMS missile loaded with 20 of the larger submunitions could destroy between three and seven vehicles.^{8/} At this level of effectiveness, a FOFA attack of 330 ATACMS missiles could destroy between 990 and 2,310 vehicles in each enemy division attacked. Another, more conservative, analysis by Steven Canby, however, estimated that an ATACMS missile is more likely to destroy between one-half and three vehicles.^{9/} This more pessimistic view stemmed from considering all the things that might go wrong, and assuming that they do. At this level of effectiveness, 330 ATACMS missiles would destroy between 165 and 990 vehicles.

Because the JSTARS sensor may not be able to distinguish between trucks and armored vehicles, and since only 25 percent of a division's vehicles are armored combat vehicles, only a quarter of the

8. Institute for Defense Analyses, *Follow-On Force Attack*, vol. I, p. III-4.

9. Steven L. Canby, "The Operational Limits of Emerging Technology," *International Defense Review* (June 1985), p. 878.